REMARKS

This is intended as a full and complete response to the Office Action dated November 8, 2005, having a shortened statutory period for response set to expire on February 8, 2006. Claims 26-28, 30, 35-37, 39, 41 and 46-61 are pending in the application and are shown above. Claims 26-28, 30, 35-37, 39, 41 and 51-61 are rejected by the Examiner. Claims 46-50 are indicated to be allowable by the Examiner. Reconsideration of the rejected claims is requested for reasons presented below.

Claim Rejections – 35 U.S.C. § 102

Claims 57-59 are rejected under 35 U.S.C. § 102(e) as being anticipated by *Chooi et al* (U.S. Patent No. 6,436,824, hereinafter "Chooi") The Examiner asserts that *Chooi et al.* discloses the subject matter of claims 57-59. Applicant respectfully responds to this rejection.

Chooi et al. discloses forming a carbon-doped silicon nitride layer by reacting a substituted ammonia precursor and a substituted organosilane in a plasma enhanced chemical vapor deposition (PECVD) chamber. Additionally, *Chooi et al.* discloses that nitrogen containing precursors of nitric oxide (NO), nitrous oxide (N_2O), nitrogen dioxide (N_2O_4) and N_2O/NF_3, may be used with the substituted organosilane to deposit a dielectric layer. *Chooi et al.* is silent as to organosiloxane compounds. Alternatively, *Chooi et al.* discloses forming a silicon carbide layer using the substituted organosilanes in a PECVD chamber. (*See,* Col. 3. line 28 to Col. 4, line 30)

Thus, *Chooi et al.* does not teach, show, or suggest introducing a processing gas comprising an organosilicon compound and a dopant selected from the group consisting of a boron-containing compound, a phosphorus-containing compound, and combinations thereof, into a processing chamber containing the substrate therein, wherein the organosilicon compound has the formula $SiH_a(CH_3)_b(C_6H_5)_c$, wherein c is 1 and a+b+c=4, and reacting the organosilicon compound to deposit a silicon carbide layer on the substrate, as recited in claim 57 and claims dependent thereon. Withdrawal of the rejection is respectfully requested.

Claim Rejections – 35 U.S.C. § 103

Claims 26, 35-37, 60-61 are rejected under 35 U.S.C. § 103(a) as being unpatentable over *Chooi* or *Laxman et al* (U.S. Publ. No. 2002/0172766) The Examiner asserts that it would have been obvious to an ordinary artisan to modify *Chooi* or *Laxman et al* to obtain devices meeting the requirements of the specific application and that it would have been obvious to use the disclosed features in the same process and the claimed ranges "overlap or lie inside ranges disclosed by the prior art and a *prima facie* case of obviousness exists. Applicant respectfully respond to the rejection.

Chooi is described above. *Laxman et al* discloses depositing a SiOC thin film using an organosilicon compound having at least one alkyl group and at least one cleavable organic functional group. *Laxman et al* further discloses that co-reactants including othern organosilicon precursors, or reactive gases including CO_2, ethylene, acetylene, N_2O, O_2, H_2, and mixtures thereof. *Chooi* and *Laxman et al* are silent as to a dopant compound is selected from the group consisting of a boron-containing compound, a phosphorus-containing compound, and combinations thereof. Furthermore, as *Chooi* and *Laxman et al* are silent to the subject matter as recited in the claims, the references of *Chooi* and *Laxman et al* cannot suggest or motivate the disclosed features of the process or present a *prima facie* case of obviousness with regard to process ranges as asserted by the Examiner.

The combination of *Chooi* and *Laxman et al* does not teach, show or suggest introducing a processing gas comprising an organosilicon compound and a dopant compound into a processing chamber containing the substrate therein, wherein the organosilicon compound consists essentially of silicon, carbon, and hydrogen, and has a carbon atom to silicon atom ratio of 6:1 or greater, wherein the dopant compound is selected from the group consisting of a boron-containing compound, a phosphorus-containing compound, and combinations thereof and reacting the organosilicon compound by a plasma enhanced chemical vapor deposition process to form the silicon carbide layer having a dielectric constant less than 4, as recited in claim 26, and claims dependent thereon. Withdrawal of the rejection is respectfully requested.

The combination of *Chooi* and *Laxman et al* does not teach, show or suggest depositing a barrier layer on the substrate on the metal features by introducing a

processing gas comprising an organosilicon compound and a dopant compound into a processing chamber containing the substrate therein and generating a plasma of the processing gas, wherein the organosilicon compound consists essentially of silicon, carbon, and hydrogen, and has a carbon atom to silicon atom ratio of about 6:1 or greater and the barrier layer has a dielectric constant less than 5 and the dopant compound is selected from the group consisting of a boron-containing compound, a phosphorus-containing compound, and combinations thereof and depositing a first dielectric layer adjacent the barrier layer, wherein the first dielectric layer comprises silicon, oxygen, and carbon and has a dielectric constant of about 3 or less, as recited in claim 35, and claims dependent thereon. Withdrawal of the rejection is respectfully requested.

The combination of *Chooi* and *Laxman et al* does not teach, show or suggest introducing a processing gas comprising an organosilicon compound and a dopant selected from the group consisting of a boron-containing compound, a phosphorus-containing compound, and combinations thereof, into a processing chamber containing the substrate therein, wherein the organosilicon compound has the formula $SiH_a(CH_3)_b(C_6H_5)_c$, wherein c is 1 and a+b+c=4, and reacting the organosilicon compound to deposit a silicon carbide layer on the substrate, as recited in claim 57, and claims dependent thereon. Withdrawal of the rejection is respectfully requested.

Claims 27-28, 30, 39, and 41 are rejected under 35 U.S.C. § 103(a) as being unpatentable over *Chooi* in view of *Xia et al* (EP 1050601). The Examiner further states that it would have been obvious to use the teachings of *Chooi et al.* with *Xia et al.* to obtain the invention as specified in claims 27-28, 30, 39, and 41. Applicants respectfully traverse the rejection.

Chooi et al. discloses forming a carbon-doped silicon nitride layer by reacting a substituted ammonia precursor and a substituted organosilane in a plasma enhanced chemical vapor deposition (PECVD) chamber. Alternatively, *Chooi et al.* discloses forming a silicon carbide layer using the substituted organosilanes in a PECVD chamber.

Xia et al. discloses forming a carbon-doped silicon oxide layer as a premetal dielectric (PMD) or intermetal dielectric (IMD) layer by reacting an organosilane

precursor and ozone in a thermal chemical vapor deposition process (thermal CVD), as opposed to a plasma enhanced CVD (PECVD) process. (See, Abstract and paragraph 38.) Applicant acknowledges that the chamber is capable of plasma enhanced CVD process, however, the deposition process as described is directed to thermal process, as opposed, to a plasma process.

Further, *Xia et al.* discloses enhancements to the thermal CVD process to be included with the organosilane precursor and ozone for PMD and IMD applications by adding boron or phosphorus dopants. (See, Abstract and paragraph 72.), which requires an organosilane precursor, ozone, and a dopant for a SiOC dielectric layer by a thermal CVD process, not a silicon carbide layer for a barrier layer. *Xia et al.* also discloses a second SiOC deposition step on the first step by energizing a process gas mixture of organosilane with nitrous oxide and *Xia et al.* is silent as to the present of a dopant in the second deposition layer. In addition, *Chooi et al.* in combination with *Xia et al.* does not teach, show, or suggest any possible combination of the PECVD process of *Chooi et al.* with the thermal CVD process of *Xia et al.* and adding a dopant to a PECVD process.

The combination of *Chooi et al.* and *Xia et al.* does not teach, show, or suggest introducing a processing gas comprising an organosilicon compound and a dopant compound into a processing chamber containing the substrate therein, wherein the organosilicon compound consists essentially of silicon, carbon, and hydrogen, and has a carbon atom to silicon atom ratio of 6:1 or greater, wherein the dopant compound is selected from the group consisting of a boron-containing compound, a phosphorus-containing compound, and combinations thereof and reacting the organosilicon compound by a plasma enhanced chemical vapor deposition process to form the silicon carbide layer having a dielectric constant less than 4, as recited in claim 26, and claims dependent thereon. Withdrawal of the rejection is respectfully requested.

The combination of *Chooi* and *Xia et al* does not teach, show or suggest depositing a barrier layer on the substrate on the metal features by introducing a processing gas comprising an organosilicon compound and a dopant compound into a processing chamber containing the substrate therein and generating a plasma of the processing gas, wherein the organosilicon compound consists essentially of silicon,

carbon, and hydrogen, and has a carbon atom to silicon atom ratio of about 6:1 or greater and the barrier layer has a dielectric constant less than 5 and the dopant compound is selected from the group consisting of a boron-containing compound, a phosphorus-containing compound, and combinations thereof and depositing a first dielectric layer adjacent the barrier layer, wherein the first dielectric layer comprises silicon, oxygen, and carbon and has a dielectric constant of about 3 or less, as recited in claim 35, and claims dependent thereon. Withdrawal of the rejection is respectfully requested.

Claims 51-56 are rejected under 35 U.S.C. § 103(a) as being unpatentable over *Chooi* in view of *Xia et al* and *Yang et al* (U.S. Patent No. 6,365,527, hereinafter "Yang"). The Examiner asserts that it would have been obvious to combine *Chooi*, *Xia et al*, and *Yang et al.* Applicants respectfully respond to this rejection.

Chooi et al. and *Xia et al* have been discussed above. *Yang et al.* discloses treating a silicon carbide layer with an ammonium plasma treatment step. The silicon carbide layer of *Yang et al.* is deposited by reacting an organosilicon compound, such as silane/methane, dimethylsilane, trimethylsilane, tetramethylsilane or other organosilicon precursor gas in a chamber. *Yang et al.* does not teach, show or suggest introducing a processing gas comprising an organosilicon compound and a dopant compound.

The combination of *Chooi*, *Xia et al*, and *Yang et al* does not teach, show, or suggest introducing a processing gas comprising an oxygen-containing compound, a dopant, and an organosilicon compound that consists essentially of silicon, carbon, and hydrogen, and has a carbon atom to silicon atom ratio of 6:1 or greater to deposit the silicon carbide layer on the substrate, wherein the dopant compound is selected from the group consisting of a boron-containing compound, a phosphorus-containing compound, and combinations thereof and reacting the organosilicon compound by a plasma enhanced chemical vapor deposition process to deposit the silicon carbide layer on the substrate, wherein the silicon carbide layer comprises less than about 15 atomic percent of oxygen, as recited in claim 51 and claims dependent thereon. Withdrawal of the rejection is respectfully requested.

In conclusion, the references cited by the Examiner, alone or in combination, do not teach, show, or suggest the invention as claimed.

The secondary references made of record are noted. However, it is believed that the secondary references are no more pertinent to the Applicant's disclosure than the primary references cited in the office action. Therefore, Applicant believes that a detailed discussion of the secondary references is not necessary for a full and complete response to this office action.

Having addressed all issues set out in the office action, Applicant respectfully submits that the claims are in condition for allowance and respectfully request that the claims be allowed.

Respectfully submitted,

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